



**DEPARTMENT OF ENERGY
Nevada Operations Office
Las Vegas, NV**

**DOE ORDER 232.1A
TRENDING & ANALYSIS
REPORT**

Fourth Quarter

1997

TABLE OF CONTENTS

Introduction	1
Highlights from the 1997 TRADE Conference	2
A Sneak Peek at the New Data Entry Program for the ORPS GUI	3
Management Summary	4
Emergency	5
Unusual Occurrence	5
Off-Normal Occurrence	5
Trending and Analysis	6
Report Timeliness	7
Notification Report	7
Update Reports	7
Final Reports	8
Backlog of Open Occurrence Reports	9
Root Cause Analysis	10
Corrective Actions	13
DOE/NV Occurrence Reports	14
Nature of Occurrence	17
Root Cause Codes and Definitions	20
Lessons Learned	28

INTRODUCTION

INTRODUCTION

This Department of Energy, Nevada Operations Office (DOE/NV) Quarterly Trending & Analysis Report (QT&AR) covers the fourth quarter of 1997. The DOE/NV QT&AR includes data from the Occurrence Reporting and Processing System (ORPS) calendar quarter, which ended December 31, 1997.

The DOE/NV QT&AR is based on DOE/NV ORPS reports issued under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information* and its earlier versions. This report consists of a management summary and statistical data on occurrences reported by DOE/NV and its contractors/users. Also, included are items of interest from events occurring at other DOE locations.

Not all of the eleven active DOE/NV contractors/users registered in ORPS as Facility Managers (FMs) for DOE/NV's thirty-four active facilities, will appear in this report. The QT&AR includes only the DOE/NV contractors/users who submitted occurrence reports in ORPS.

The abbreviations (recognized by ORPS) for the DOE/NV contractors/users appearing in this report follow:

BNLV	Bechtel Nevada
DSWA	Defense Special Weapons Agency
GONV	Nevada Operations Office
ITNV	IT Corporation
LANV	Los Alamos National Laboratory - Nevada
LLNV	Lawrence Livermore National Laboratory - Nevada
SDNL	Sandia National Laboratory, Nevada
WSIN	Wackenhut Services, Inc.

INTRODUCTION

HIGHLIGHTS FROM THE 1997 TRADE CONFERENCE **an excerpt from the December 1997 ORPS Bulletin**

The 1997 Training Resources and Data Exchange (TRADE) Conference was held December 1-5, 1997, in Denver, Colorado. The focus for this years' TRADE Conference was *Focus on Business Performance: Maximizing Our Return on Investment (ROI)*.

As part of the TRADE Conference, the Occurrence Reporting Special Interest Group (OR SIG) sponsored various presentations, Task Team discussions, and TRADEing POST displays and demonstrations. Some occurrence reporting related sessions included OR SIG Cost Savings; Occurrence Report Quality; Open Forum on the New ORPS Graphical User Interface Data Entry Program; Functional Area Trending Program; Lessons Learned from ETTP (formerly K-25) Welding Fatality; Dissemination of Lessons Learned from a Facility's Perspective; Comparative Events Data and Significance Analysis of Major DOE Program Offices; Sharing Lessons Learned Within DOE; and Making Business Decisions Using Trend Information. In addition, many OR SIG Task Teams met to discuss ongoing and future activities.

At various times during the conference, recommendations from ORPS users were gathered to identify specific requirements for the new ORPS Data Entry Program which will replace the existing PC ORPS (Windows and DOS). Some specifications for the program have already been identified based on the existing PC ORPS program and the initial development of the ORPS Data Entry Program is currently underway. The discussions held at the TRADE conference provided an opportunity for ORPS users to identify those positive aspects of the existing PC ORPS program that should be retained and what items need to be improved or added.

The ORPS Graphical User Interface (GUI) went into production in March 1997. The ORPS GUI included only the General Users functions. All the Facility Manager, Facility Representative, Program Manager functions must still be completed using the HP-3000 computer.

A tentative date, July 1998, is scheduled for the termination of the HP-3000 computer. It is, of course, essential that occurrence report data entry, Facility Manager, Facility Representative, Program Manager functions be available through the ORPS GUI before the HP-3000 can be terminated. Facility Managers and Facility Representatives are asked to review the ORPS Authority File for validity.

INTRODUCTION

A SNEAK PEEK AT THE NEW DATA ENTRY PROGRAM FOR THE ORPS GUI

an excerpt from the December 1997 ORPS Bulletin

The new ORPS Data Entry Program is designed to run as a client/server-based application using Netscape 3.0 or later. Similar to the existing ORPS Graphical User Interface (GUI), the new ORPS Data Entry Program will be accessed via the Internet using a Secure Socket Layer (SSL) encrypted link.

Once data entry personnel log onto the system (ORPS userid and password), they can create a new report, modify or print an existing report, export a report into the ASCII format, or check on the status of the communication link between the ORPS Data Entry Program and the ORPS data base. Data entry personnel can only create and modify reports (i.e., Notification, Update, and Final) for the facility(s) for which they have been designated data entry responsibility, as specified in the ORPS Authority File. Not only can data entry personnel access their own reports, but they can also access all other reports generated by other data entry personnel for their facility(s).

The layout, look, and feel of the ORPS Data Entry Program is very similar to the current PC ORPS for Windows. The full occurrence report is now on one continuous page. Buttons to Save, Close, Validate, Delete, or request Help will always remain visible in the bottom frame. The feather at the top of the window is a spell checker. Automatic spell checking will be done as words are typed into the field. Misspelled words will be identified by an audible signal. A correction will not be required at that time but a click on the feather will bring up a normal spell check dialog box with suggested alternatives. In addition, each time the report is saved the system will remind the user to run a spell check before transmittal.

The development of the ORPS Data Entry Program is still underway. New ideas for the program were gathered at the 1997 TRADE Conference and will be incorporated in the development of the program. More information on the new ORPS Data Entry Program will be provided in future issues of the ORPS Bulletin.

Training for the new ORPS Data Entry Program is scheduled during the 1998 ORPS Users' Workshop and TRADE OR SIG Spring Meeting in May 1998. Facility Managers and Facility Representatives or their designees should consider attending this training. To find out more information about the ORPS Data Base Access, ORPS Bulletins/Publications, OR SIG, and Upcoming Occurrence Reporting Workshops/Meetings, access the **Occurrence Reporting Program** homepage (<http://tis.eh.doe.gov/web/oeaf/orps/orps.html>).

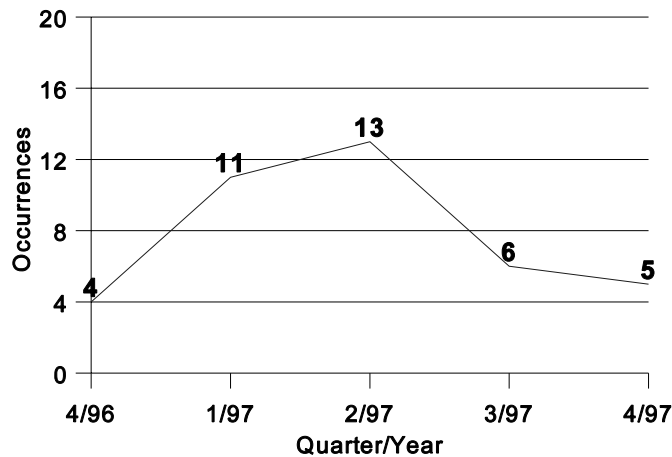
MANAGEMENT SUMMARY

MANAGEMENT SUMMARY

This section summarizes general trends, observations, and lessons learned during the compilation, evaluation, and reporting of occurrences for this quarter. Based on the occurrence discovery date, ORPS identified five new reports this quarter.

Occurrence Distribution

October 1, 1996 to December 31, 1997



Occurrences by Contractor August 1, 1990 to December 31, 1997

Contractor	BNLV	DSWA	GONV	ITNV	LANV	LLNV	SDNL	WSIN
Total	36	2	8	1	4	14	7	75
Quarter	3	0	0	0	0	0	0	2

MANAGEMENT SUMMARY

Emergency

DOE/NV has never categorized an event as an "Emergency" since the start of ORPS.

Unusual Occurrence

DOE/NV categorized two events as Unusual Occurrences (UOs) this quarter. Both were reported under the Safeguards/Security ORPS reporting area.

DOE/NV has reported 64 occurrences as UOs since the start of ORPS. They reported them under the following ORPS reporting areas: Safeguards/Security (56%), Environmental (20%), Facility Condition (11%), Personnel Safety (8%), Facility Status (3%), Value Basis Reporting (1%), and Cross-Category Items (1%). Note that occurrences may be categorized under more than one reporting area.

Off-Normal Occurrence

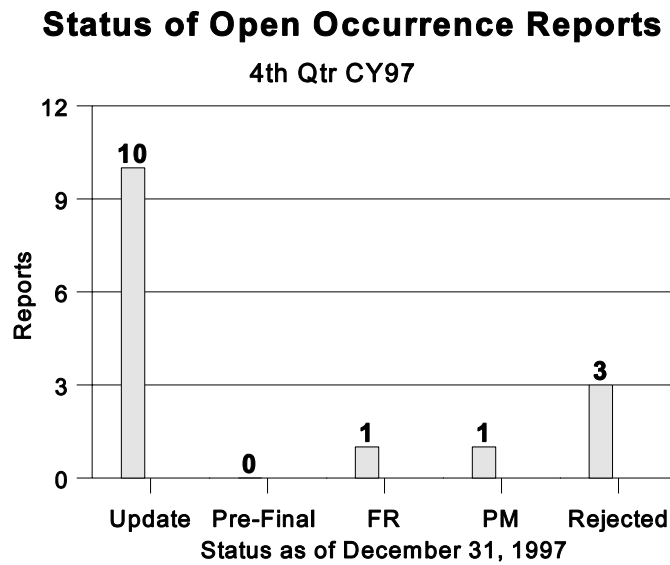
DOE/NV categorized three events as Off-Normal Occurrences (ONs) this quarter. They reported them under the following ORPS reporting areas: one under Personnel Safety, one under Safeguards/Security, and one under Cross-Category Items.

DOE/NV has reported 617 occurrences as ONs since the start of ORPS. They reported them under the following ORPS reporting areas: Facility Condition (31%), Environmental (21%), Personnel Safety (15%), Safeguards/Security (10%), Cross-Category Items (10%), Personnel Radiation Protection (5%), Value Basis Reporting (4%), Transportation (2%), Facility Status (1%), and Nuclear Explosive Safety (1%).

TRENDING AND ANALYSIS

TRENDING AND ANALYSIS

Since the start of ORPS, DOE/NV has reported 681 occurrence reports. As of December 31, 1997, 666 occurrence reports have been completed. Of the fifteen reports that remain open, twelve are being completed and three have been rejected pending further action.

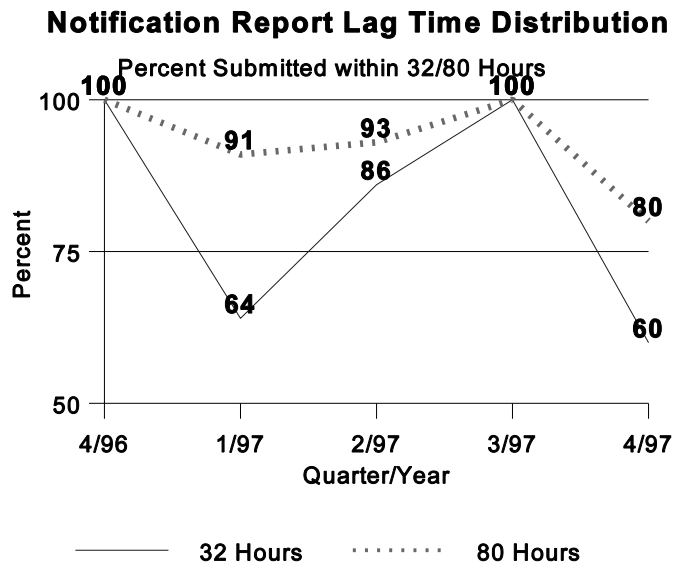


REPORT TIMELINESS

REPORT TIMELINESS

Notification Reports

DOE Order 232.1A requires submittal of a Notification Occurrence Report (NOR) within 80 hours of the time of categorization. DOE/NV submitted 60% percent by the close of the next business day and 80% within the 80-hour criterion this quarter.



Notification Report Lag Time 4th Qtr CY97

Hours	0 - 5	6 - 10	11 - 15	16 - 20	21 - 25	26 - 30	30+
Reports	1	2	0	0	0	0	2

Update Reports

The FM submits an Update Occurrence Report (UOR) when significant and new information is available or upon request by DOE/NV. They will submit a UOR within 45 days after categorization if the required analysis of an event cannot be completed.

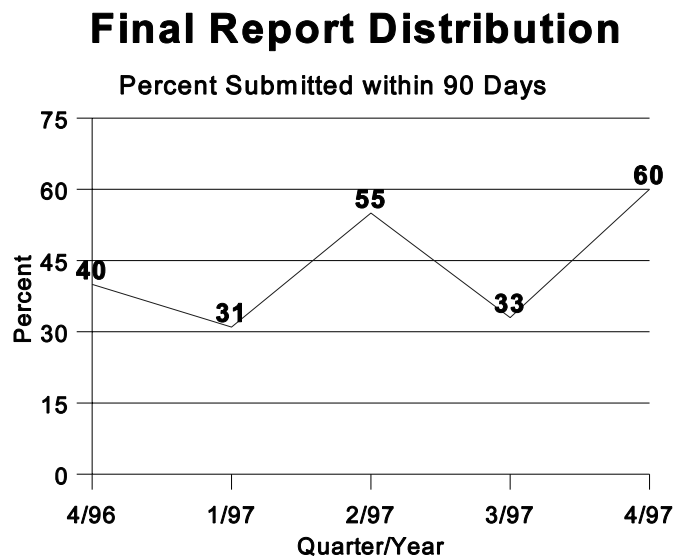
REPORT TIMELINESS

The report will explain the delay and provide an estimated date for submittal of the Final Occurrence Report (FOR).

Final Reports

The FM completes an FOR and submits the FOR to the FR as soon as practical, but within 45 calendar days after categorization. The FR will review, approve, add any comments, and forward the FOR to the PM within 10 calendar days of receipt. The PM will review, approve, and add any comments to the FOR within 14 days of receipt. If either the FR or the PM has not approved the FOR, they will return it to the FM with an explanation for the disapproval. An FOR is considered final when the FM, FR, and/or PM have all approved and signed the report.

DOE Order 232.1A establishes a 45-calendar-day criterion for completion of FORs by the FM. DOE/HQ established an internal goal that 90% of reports should meet the 45-day criteria. The QT&AR follows that criterion here for comparison purposes. Analysis of data for this quarter shows a percentage increase from a year ago and a percentage increase from the preceding quarter. During this quarter, five FORs were submitted with an average lag time of 76 days. Three of the FORs met the 90-day criterion and two met the 45-day criterion.



REPORT TIMELINESS

Final Report Lag Time 4th Qtr CY97

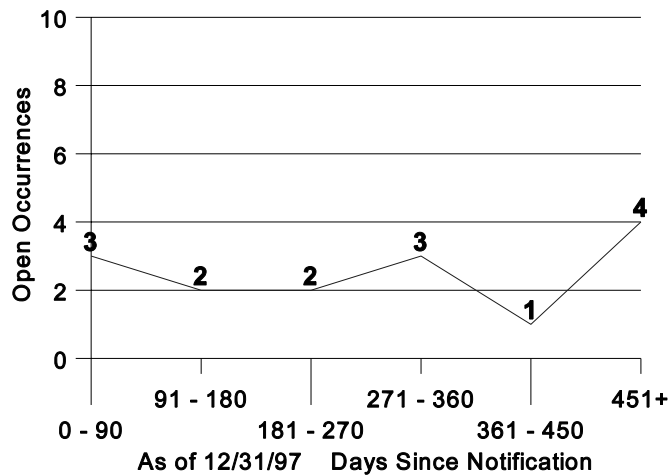
Days	0 - 15	16 - 30	31 - 45	46 - 60	61 - 75	76 - 90	90+
Reports	1	1	0	0	1	0	2

Backlog of Open Occurrence Reports

As of December 31, 1997, DOE/NV had fifteen open occurrence reports. Twelve reports have been open longer than 90 days. One report, still in the pre-final stage, has been open more than 500 days. Three reports, still in the pre-final stage, have been open more than 700 days. DOE/HQ rejected one open occurrence report. DOE/NV rejected two open occurrence reports. These reports are awaiting further action. The remaining twelve open occurrence reports are awaiting an update or pre-final action.

Age of Open Occurrence Reports

4th Qtr CY97



ROOT CAUSE ANALYSIS

ROOT CAUSE ANALYSIS

Since the start of ORPS, DOE/NV has reported 675 root causes with the following distribution:

Management Problem at 26%, with the following subgroups identified (1) Inadequate Administrative Control and (2) Policy Not Adequately Defined, Disseminated, or Enforced.

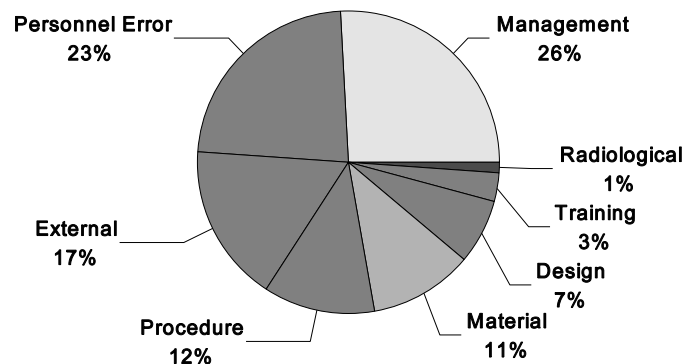
Personnel Error at 23%, with the following subgroups identified (1) Inattention to Detail, (2) Procedure Not Used or Used Incorrectly, and (3) Other Human Error.

External Phenomena at 17%, with the following subgroups identified (1) Weather or Ambient Condition and (2) Theft, Tampering, Sabotage, Vandalism.

The remaining root causes are Procedure Problem 12%, Equipment/Material 11%, Design Problem 7%, Training Deficiency 3%, and Radiological/Hazardous Material Problem 1%.

Root Cause

August 1, 1990 to December 31, 1997



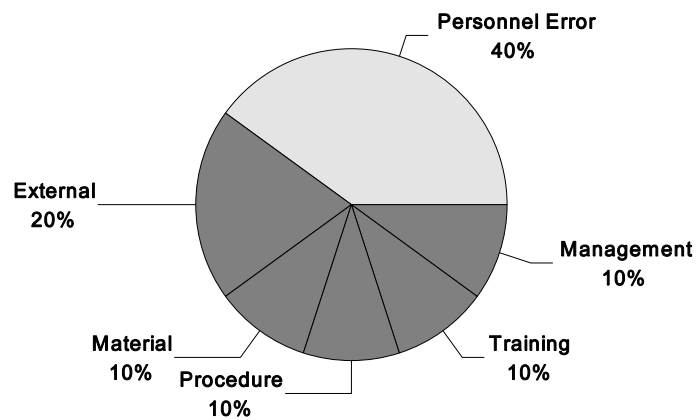
ROOT CAUSE ANALYSIS

This quarter, DOE/NV reported ten root causes with the following distribution:

Personnel Error 40%
External Phenomena 20%
Equipment/Material Problem 10%
Procedure Problem 10%
Training Deficiency 10%
Management Problem 10%

Root Cause

4th Qtr CY97



ROOT CAUSE ANALYSIS

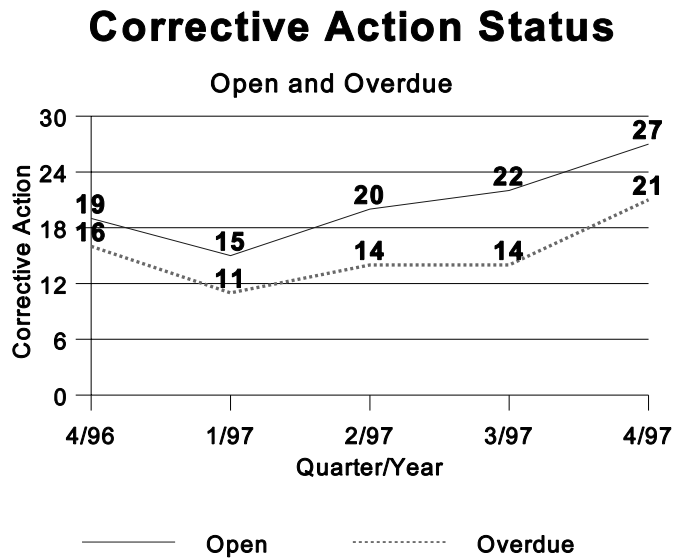
Root Cause Distribution Breakdown by Category

Root Cause	Total	Quarter
Equipment/Material	78	1
Procedure Problem	84	1
Personnel Error	153	4
Design Problem	50	0
Training Deficiency	17	1
Management Problem	174	1
External Phenomena	114	2
Radiological/Hazardous Material Problem	1	0
Other	4	0

CORRECTIVE ACTIONS

CORRECTIVE ACTIONS

As of December 31, 1997, DOE/NV had twenty-seven open corrective actions. Twenty-one of these are overdue. Note that because revised target completion dates are included each quarter, comparisons between quarterly corrective action status data are not meaningful. The distribution of actions changes whenever the status is updated.



DOE/NV OCCURRENCE REPORTS

DOE/NV OCCURRENCE REPORTS

excerpts from the occurrence reports residing in ORPS

DOE/NV categorized five events under ORPS for this quarter, three as UOs and two as ONs. Address any questions or comments to Deborah Binder at 295-6351 or the EOC personnel at 295-1422. An occurrence description for each event follows.

Substance Abuse

(NVOO--BNLV-NTS-1997-0014)

On October 29, 1997, at 1800 hours, the Bechtel Nevada Devise Assembly Facility (DAF) Support Manager was called to the DAF controlled entry gate by the Wackenhut Services, Inc. guard. The DAF Support Manager was advised that one of the Facility Maintenance Craftsmen smelled as if he had been drinking alcohol. The suspected individual appeared to be impaired as he was observed to be staggering. Upon entering the DAF, the DAF Support Manager instructed both individuals to go to the conference room for scheduled safety training. The DAF Support Manager contacted the Craftsman's supervisor. The supervisor had the same observations regarding the Craftsman. The DAF Support Manager instructed the General Foreman (GF) to escort the suspected intoxicated individual to Mercury Medical for a drug/alcohol test. However, when the GF and the individual arrived at the hospital, the individual refused to take the drug/alcohol test. The individual's security badge was taken by the security guard at the gate. An investigation is underway to determine the employment of the individual involved in this occurrence.

Vehicle Accident

(NVOO--BNLV-NTS-1997-0015)

On November 4, 1997, at approximately 0600 hours, a two-vehicle accident occurred. Vehicle No. 1, a government-owned vehicle, operated by a Bechtel Nevada employee, was northbound on Nevada State Highway 95. The employee was returning Vehicle No. 1 to the Nevada Test Site. The employee was traveling in the outside lane approaching the Centennial Parkway intersection. A semi-tractor-trailer was waiting to cross the intersection, when Vehicle No. 2 (vehicle behind semi-tractor-trailer) went around the left-side of the semi-tractor-trailer and entered Nevada State Highway 95. The Bechtel Nevada employee in Vehicle No. 1 had no chance to stop or avoid the collision with Vehicle No. 2. The employee in Vehicle No. 1 was wearing seat restraints. The vehicle was not equipped with an air bag. The Nevada Highway Patrol cited the operator of Vehicle No. 2. The employee in Vehicle No. 1 suffered the following injuries: a cracked sternum and ribs, compound fractures to the tibia and fibula, a contusion on the heart, and other minor cuts, abrasions, and bruises. She was

DOE/NV OCCURRENCE REPORTS

transported to the University Medical Center for treatment. The operator of Vehicle No. 2 was also transported to the University Medical Center. The extent of the operators injuries are unknown at this time.

Near Miss of Severe Electrical Shock (NVOO--BNLV-NTS-1997-0016)

On December 20, 1997, at 0819 hours, two Bechtel Nevada Electrical Linemen were attempting to switch a 4-kv circuit at the Mercury Substation when a flash over occurred. The two linemen received minor burns on the hand as a consequence. The linemen were taken to the Mercury Fire Department at 0829 hours. They were then transported to the University Medical Center for treatment and released back to work. Work at the substation was stopped until a determination was made that the rest of the operation would be safe. The switching order was rewritten to work around the flashed over circuit. The remainder of the day's work was performed without incident.

Demonstration/Protest (NVOO--WSIN-NTS2-1997-0012)

On Monday, October 13, 1997, at approximately 0625 hours, approximately 65 personnel gathered at the entrance to the Nevada Test Site near the cattle guard. At 0630 hours, the demonstrators blocked Mercury Highway. The road was cleared of demonstrators at 0638 hours and reopened to traffic. Members of the protest group included Healing Global Wounds, Western Shoshone Nation and the Nevada Desert Experience. Twenty-six personnel were arrested and retained in the holding area near the cattle guard.

Other than the initial blocking of Mercury Highway, the gathering was peaceful. Arrested personnel were cited and released at 0955 hours by the Nye County Sheriff's Office. One minor injury to a demonstrator (her wrist) was reported. All personnel departed the area at approximately 1000 hours.

Demonstration/Protest (NVOO--WSIN-NTS2-1997-0013)

On Sunday, November 9, 1997, at approximately 0830 hours, an estimated 200 personnel gathered at the entrance to the Nevada Test Site near the cattle guard. The gathering was peaceful, however, 150 demonstrators were arrested. They were cited and released by the Nye County Sheriff's Office. No injuries were reported. Members of the protest group were affiliated with the Nevada Desert Experience, Catholic Workers Conference, Shoshone Indian Nation, and Veterans for Peace. Nye County Sheriff's Office was assisted by the Wackenhut Services Inc. Protective Force

DOE/NV OCCURRENCE REPORTS

and the Nevada Highway Patrol. All personnel departed the area at approximately 1350 hours.

NATURE OF OCCURRENCE

NATURE OF OCCURRENCE

Nature of Occurrence Codes

1	Facility Condition	6	Transportation
2	Environmental	7	Value Basis Reporting
3	Personnel Safety	8	Facility Status
4	Personnel Radiation Protection	9	Nuclear Explosive Safety
5	Safeguards and Security	10	Cross-Category

Items

NATURE OF OCCURRENCE DISTRIBUTION AUGUST 1, 1990 TO DECEMBER 31, 1997

Nature of Occurrence	1	2	3	4	5	6	7	8	9	10
Total	204	146	102	33	104	15	24	11	2	65
Quarter	0	0	1	0	3	0	0	0	0	1

BNLV NATURE OF OCCURRENCE

Nature of Occurrence	1	2	3	4	5	6	7	8	9	10
Total	9	6	5	4	4	4	2	0	0	3
Quarter	0	0	1	0	1	0	0	0	0	1

DSWA NATURE OF OCCURRENCE

Nature of Occurrence	1	2	3	4	5	6	7	8	9	10
Total	0	0	0	2	0	0	0	0	0	0
Quarter	0	0	0	0	0	0	0	0	0	0

NATURE OF OCCURRENCE

NATURE OF OCCURRENCE

Nature of Occurrence Codes

1	Facility Condition	6	Transportation
2	Environmental	7	Value Basis Reporting
3	Personnel Safety	8	Facility Status
4	Personnel Radiation Protection	9	Nuclear Explosive Safety
5	Safeguards and Security	10	Cross-Category

Items

GONV NATURE OF OCCURRENCE

Nature of Occurrence	1	2	3	4	5	6	7	8	9	10
Total	5	1	0	0	1	0	0	0	0	1
Quarter	0	0	0	0	0	0	0	0	0	0

ITNV NATURE OF OCCURRENCE

Nature of Occurrence	1	2	3	4	5	6	7	8	9	10
Total	0	1	0	0	0	0	0	0	0	0
Quarter	0	0	0	0	0	0	0	0	0	0

LANV NATURE OF OCCURRENCE

Nature of Occurrence	1	2	3	4	5	6	7	8	9	10
Total	5	0	1	0	0	0	0	0	0	2
Quarter	0	0	0	0	0	0	0	0	0	0

NATURE OF OCCURRENCE

NATURE OF OCCURRENCE

Nature of Occurrence Codes

1	Facility Condition	6	Transportation
2	Environmental	7	Value Basis Reporting
3	Personnel Safety	8	Facility Status
4	Personnel Radiation Protection	9	Nuclear Explosive Safety
5	Safeguards and Security	10	Cross-Category

Items

LLNV NATURE OF OCCURRENCE

Nature of Occurrence	1	2	3	4	5	6	7	8	9	10
Total	2	0	2	3	0	1	1	1	0	2
Quarter	0	0	0	0	0	0	0	0	0	0

SDNL NATURE OF OCCURRENCE

Nature of Occurrence	1	2	3	4	5	6	7	8	9	10
Total	0	3	3	0	0	0	0	0	0	1
Quarter	0	0	0	0	0	0	0	0	0	0

WSIN NATURE OF OCCURRENCE

Nature of Occurrence	1	2	3	4	5	6	7	8	9	10
Total	1	0	16	0	47	0	2	0	2	2
Quarter	0	0	0	0	2	0	0	0	0	0

ROOT CAUSE CODES AND DEFINITIONS

ROOT CAUSE CODES AND DEFINITIONS

Equipment/Material Problem: An event or condition resulting from the failure, malfunction, or deterioration of equipment or parts, including instruments or material.

- 1A. **Defective or Failed Part:** A part/instrument that lacks something essential to perform its intended function.
 - 1B. **Defective or Failed Material:** A material defect or failure.
 - 1C. **Defective Weld, Braze, or Soldered Joint:** A specific weld/joint defect or failure.
 - 1D. **Error by Manufacturer in Shipping or Marking:** An error by the manufacturer or supplier in the shipping or marking of equipment.
 - 1E. **Electrical or Instrument Noise:** An unwanted signal or disturbance that interferes with the operation of equipment.
 - 1F. **Contaminant:** Failure or degradation due to radiation damage or foreign material such as dirt, crud, or impurities.
 - 1G. **End of Life Failure:** A failure where the equipment or material is run to failure and has reached its end of design life.
1. Equipment/Material Problems reported prior to 4/1/91.

EQUIPMENT/MATERIAL PROBLEM

Root Cause Code	1A	1B	1C	1D	1E	1F	1G	1
Total	45	23	0	3	0	6	0	1
Quarter	0	1	0	0	0	0	0	0

ROOT CAUSE CODES AND DEFINITIONS

Procedure Problem: An event or condition that can be traced to the lack of a procedure, an error in a procedure, or a procedural deficiency or inadequacy.

- 2A. **Defective or Inadequate Procedure:** A procedure that either contains an error or lacks something essential to the successful performance of the activity.
- 2B. **Lack of Procedure:** No written procedure was in place to perform the activity.
- 2. Procedure Problems reported prior to 4/1/91.

PROCEDURE PROBLEM

Root Cause Code	2A	2B	2
Total	38	44	2
Quarter	1	0	0

ROOT CAUSE CODES AND DEFINITIONS

Personnel Error: An event or condition due to an error, mistake, or oversight.

- 3A. **Inattention to Detail:** Inadequate attention to the specific details of the task.
 - 3B. **Procedure Not Used or Used Incorrectly:** The failure to use or the inappropriate use of written instructions, procedures, or other documentation.
 - 3C. **Communication Problem:** Inadequate presentation or exchange of information.
 - 3D. **Other Human Error:** Human error other than those described above.
3. Personnel Errors reported prior to 4/1/91.

PERSONNEL ERROR

Root Cause Code	3A	3B	3C	3D	3
Total	56	46	6	35	10
Quarter	2	1	0	1	0

ROOT CAUSE CODES AND DEFINITIONS

Design Problem: An event or condition that can be traced to a defect in design or other factors related to configuration, engineering, layout, tolerances, calculations, etc.

- 4A. **Inadequate Work Environment:** Inadequate design of equipment used to communicate information from the facility to a person (e.g., displays, labels, etc.) as well as inadequate work environment, such as inadequate lighting, working space, or other human factor considerations.
 - 4B. **Inadequate or Defective Design:** A design in which something essential was lacking (defective) or when a detail was included but was not adequate for the requirement (inadequate).
 - 4C. **Error in Equipment or Material Selection:** A mistake in the equipment or material selection only, not to include a procurement error (see Personnel Error (d) Other Human Error) or a specification error (see Design Problem - (d) Drawing, Specification, or Data Errors).
 - 4D. **Drawing, Specification, or Data Errors:** An error in the calculation, information, or specification of a design.
- 4 . Design Problems reported prior to 4/1/91.

DESIGN PROBLEM

Root Cause Code	4A	4B	4C	4D	4
Total	3	37	9	0	1
Quarter	0	0	0	0	0

ROOT CAUSE CODES AND DEFINITIONS

Training Deficiency: An event or condition that can be traced to a lack of training or insufficient training to enable a person to perform a desired task adequately.

- 5A. **No Training Provided:** A lack of appropriate training.
 - 5B. **Insufficient Practice or Hands-On Experience:** An inadequate amount of preparation before performing the activity.
 - 5C. **Inadequate Content:** The knowledge and skills required to perform the task or job were not identified.
 - 5D. **Insufficient Refresher Training:** The frequency of refresher training was not sufficient to maintain the required knowledge and skills.
 - 5E. **Inadequate Presentation or Materials:** The training presentation or materials were insufficient to provide adequate instruction.
5. Training Deficiencies reported prior to 4/1/91.

TRAINING DEFICIENCY

Root Cause Code	5A	5B	5C	5D	5E	5
Total	2	3	2	4	1	5
Quarter	1	0	0	0	0	0

ROOT CAUSE CODES AND DEFINITIONS

Management Problem: An event or condition that can be directly traced to managerial actions or methods.

- 6A. **Inadequate Administrative Control:** A deficiency in the controls in place to administer and direct activities.
 - 6B. **Work Organization/Planning Deficiency:** A deficiency in the planning, scoping, assignment, or scheduling of work.
 - 6C. **Inadequate Supervision:** Inadequate techniques used to direct workers in the accomplishment of tasks.
 - 6D. **Improper Resource Allocation:** Improper personnel or material allocation resulting in the inability to successfully perform assigned tasks.
 - 6E. **Policy Not Adequately Defined, Disseminated, or Enforced:** Inadequate description, distribution, or enforcement of policies and expectations.
 - 6F. **Other Management Problem:** A management problem other than those defined above.
6. Management Problems reported prior to 4/1/91.

MANAGEMENT PROBLEM

Root Cause Code	6A	6B	6C	6D	6E	6F	6
Total	52	30	15	3	38	34	2
Quarter	0	0	0	0	1	0	0

ROOT CAUSE CODES AND DEFINITIONS

External Phenomena: An event or condition caused by factors that are not under the control of the reporting organization or the suppliers of the failed equipment or service.

- 7A. **Weather or Ambient Condition:** Unusual weather or ambient conditions, including hurricanes, tornadoes, flooding, earthquake, and lightning.
- 7B. **Power Failure or Transient:** Special cases of power loss that are attributable to outside supplied power.
- 7C. **External Fire or Explosion:** An external fire, explosion, or implosion.
- 7D. **Theft, Tampering, Sabotage, or Vandalism:** Theft, tampering, sabotage, or vandalism that could not have been prevented by the reporting organization.

EXTERNAL PHENOMENA

Root Cause Code	7A	7B	7C	7D
Total	57	13	1	43
Quarter	2	0	0	0

ROOT CAUSE CODES AND DEFINITIONS

Radiological/Hazardous Material Problem: An event related to radiological or hazardous material contamination that cannot be attributed to any of the other causes.

- 8A. **Legacy Contamination:** Radiological or hazardous material contamination attributed to past practices.
- 8B. **Source Unknown:** Radiological or hazardous material contamination where the source cannot be reasonably determined.

RADIOLOGICAL/HAZARDOUS MATERIAL PROBLEM

Root Cause Code	8A	8B
Total	1	0
Quarter	0	0

Other: Other problems reported prior to 4/1/91.

OTHER

Root Cause Code	9
Total	4
Quarter	0

LESSONS LEARNED

LESSONS LEARNED

excerpts from the DOE Lessons Learned Information Services

The following section discusses selected final reports that go beyond the minimum requirements of DOE Order 232.1A in providing lessons learned worth distributing to the DOE community.

Classified Document Identification Tool

Lessons Learned: Using the same type of cover sheet for accountable and nonaccountable classified documents can result in misidentification and potentially the destruction of incorrect documents. To guard against this type of problem, the Laboratory designed new cover sheets for accountable documents that look different from the cover sheets for nonaccountable documents. Use of the new cover sheets is mandatory, and they will be placed on accountable documents as the documents are inventoried this year.

Discussion: After an employee received a new personal safe approved for storing classified documents, he began transferring classified documents stored in his group's community safe to his personal safe. Simultaneously, the employee destroyed several documents that were no longer needed. Both the accountable and nonaccountable documents stored under the employee's name used the same type of cover sheet, and the employee assumed that all the documents he destroyed were nonaccountable.

The employee subsequently moved to a new office. Shortly after the employee moved, the classified document custodian responsible for the community safe requested an accountable document from the employee. However, the employee was unable to find the document after conducting a 100 percent inventory of his personal safe. The community safe and other personal safes were also inventoried, but the accountable document was not found.

Investigators later determined that several involved employees were unfamiliar with the special handling and disposal requirements for accountable documents because they did not handle accountable classified documents routinely. Therefore, the Laboratory's information security briefing was updated to include specific information on proper handling and disposal of accountable classified documents.

In addition to the new cover sheets that are being phased into use, the classified document custodian for the community safe also set aside a dedicated space in the safe for accountable files to prevent them from being mixed in with nonaccountable documents.

LESSONS LEARNED

Recommended Actions: Ensure that your facility uses easily distinguishable classified document cover sheets, and segregate accountable and nonaccountable documents stored in the same location to prevent potential mishandling because of misidentification. Review information security training programs to ensure that they provide adequate handling and disposal information for classified documents.

Contamination Identified in Non-Radiological Area at K-1015 Laundry

Lessons Learned: Areas down-posted to a non-radiological area, should be periodically checked and re-surveyed for radiological contamination if cracks or other physical changes are observed.

Discussion: During a DOE Safety and Health Focused Safety Management Evaluation of the East Tennessee Technology Park (ETTP), an auditor requested that a Radiological Control Technician (RCT) survey a non-radiological area adjacent to a posted radiological area on the north side of Building K-1015 Laundry Facility. During this survey on June 11, 1997, several spots of contamination were found along the building's foundation and in cracks alongside a concrete pad. Background information indicated the facility has been shut down for approximately 18 months. The particular area in question was previously posted as a contamination area but had been down posted to a non-radiological area after being surveyed in November 1995.

Between August 1, 1995 and September 29, 1995, all four lint collectors located on the north side of Building K-1015 were within a contamination area.

On November 27, 1995 and November 28, 1995, the four lint collectors and surrounding area were surveyed for possible down posting.

Also, on November 28, 1995, lint collector's No. 3 and No. 4 and the areas surrounding the collectors were down posted to a non-radiological area. Lint collectors' No. 1 and No. 2 and the surrounding areas were down posted from a contamination area to a fixed contamination area.

On June 12, 1997, an auditor working with the Focused Safety Management team requested that several areas around the two lint collectors in the non-radiological area be surveyed. Contamination was found in the area. Most of the contamination was found in the joint between the building and the asphalt.

Analysis: Three possible scenarios or a combination of events may have contributed in contamination being outside the posted radiological area.

LESSONS LEARNED

First, after a careful review of the down posting surveys the contaminated spots may have been overlooked by the RCT. The survey does not specifically show readings taken in the exact locations where the contamination was discovered. The RCT who performed the down posting survey left the payroll in December 1996, so it could not be determined when the cracks in the asphalt appeared, the cracks may not have existed at the time of the down posting survey. Thus, the asphalt may have shielded the contamination from detection by the RCT's survey instruments.

Second, based on where the contamination was discovered, possible leaching of radioactivity in the soil to a detectable level by our survey instruments is a possibility.

Third, there had been almost a continuous 20-day rain before the discovery of the contamination. A fixed contamination area is adjacent to the area where the contamination was found. A survey of lint inside the lint collectors within the fixed contamination area was found contaminated above the limit for a fixed contamination area. Immediately, the open ports of the lint collectors were covered with plastic, and secured with duct tape to contain the exposed lint (the use of plastic and duct tape was only a temporary fix). The fixed contamination area was up-posted to a contamination area. A few days later, water had collected in the plastic placed over the exhaust ducts of the lint collectors. Outlined surveys around the perimeter of the existing contamination area did not show the spread of contamination.

Of these three possible causes, the third one has been verified through observations and survey data. Surveys of the soil, lint, and vegetation (moss) in the area all showed elevated levels of radioactivity.

Recommended Actions: A comprehensive survey of this facility has been performed on the outside of the building. Results indicate that the building was correctly posted except a small section on the north side of the sludge pit that showed micro-rem levels exceeding twice background. The posting (contamination area) in this area was extended approximately one foot north of the pit to include the area exceeding twice background.

Postings around the four lint collectors on the north side of the building were modified to reflect the current conditions (contamination area). The lint collectors that were within the previously posted fixed contamination area (No. 1 and No. 2) were placarded with "Internal Contamination" stickers. Lint collectors that were previously in the non-radiological area (No. 3 and No. 4) were placarded with "Possible Internal Contamination" stickers. The building operator of this facility has been contacted and efforts are in progress to prevent potential contamination from exiting the lint collection system. Routine surveillances are conducted after rain to ensure contamination has not spread from the contamination area. Also, barriers "hot dogs" have been placed

LESSONS LEARNED

along perimeters to capture any lint that may be washed out of the lint collection system.

1. A formal process for down posting that will ensure reproducibility of surveys and allow a total picture of the down posting activities to be recreated should be developed. The process should include the following:
 - A documented plan for release surveys (types of measurements, how documented; address cracks, breaks, holes, etc.).
 - A review of the survey documentation package by a Radiological Engineer before down posting and approval.
2. Routine surveys around shutdown facilities, abandoned-in-place facilities, and stand by facilities need to be planned to recognize potential changing conditions in previously down posted areas. For example, contamination leaching to the surface in cracks due to rain, or indoor sources causing the spread of contamination within a facility.

Other facilities should review facility conditions and previous surveys for non-radiological areas that are adjacent to posted radiological areas. This review should determine the need to conduct additional surveys.

Minimizing Personnel Contaminations by Labeling Internal Packaging

Lessons Learned: When packaging radioactive material for shipment, personnel contamination incidents during unpackaging can be minimized by placing a label on the layer of packaging immediately before contamination is expected to be contacted.

Discussion: During a recent unpackaging evolution, a radiological control technician (RCT) contaminated his fingers with plutonium powder while he was removing packaging between the shipping container and the secondary containment (a poly bag). Based on verbal information provided by the visiting scientist who ordered the material, the RCT anticipated that the shipment contained solid/oxide plutonium on metal sources. Therefore, he wore surgical gloves to unpackage the items. One of his gloves failed, and powder migrated through a small tear in one fingertip while he was handling the poly bag to identify serial numbers on glass vials found in the package. The RCT monitored himself when he noticed the powder on his gloves, preventing further spread of contamination.

The RCT's assumptions about the content of the shipment contributed to this incident; however, the shipping papers also incorrectly identified the radioactive material as

LESSONS LEARNED

solid/oxide on metal. Personnel subsequently discovered a packaging diagram among the shipping papers that indicated more layers of packaging than actually existed and that contamination should be expected at a particular point that could not be readily identified from the incorrect diagram.

Analysis: Although DOE and Department of Transportation requirements do not require labeling of packaging within the shipping container, it is a good work practice to provide a label with contamination levels on the layer of packaging before contamination levels are anticipated to allow receivers to unpackage the material with the proper precautions. Doing so will thereby reduce the chances for personnel and area contamination incidents within your own or another's facility.

Recommended Actions: This information should be shared with individuals responsible for packaging shipments on or off site. Facility inter-laboratory and intra-laboratory transfer and shipment procedures should be reviewed and revised to include a requirement for labeling of the interior packaging layers.

Trailer Destroyed by Fire

Lessons Learned: After periods of unuse, HVAC systems in relocatable structures (such as trailers) should receive a general inspection. The inspection should include heating units and all downstream ductwork. Ignitable foreign material may accumulate in ductwork during periods of unuse. Such material poses a potential fire hazard.

Discussion: A fire was reported in a trailer used by construction personnel as office space and for breaks. Shortly before the fire started, personnel turned on two electric heaters in the trailer. When workers smelled burning wire and saw smoke, they contacted the fire department and evacuated the trailer.

The fire produced heavy flames and smoke inside the trailer. Fire fighting personnel were forced to abandon an interior attack and fought the fire from the outside. The only injury (a sprained ankle) was sustained by a firefighter who stepped into a trench. The trench was opened for the installation of a fire alarm system to the trailer.

The trailer was used at the site for more than eight years. Although it was recently moved to a new location, no alterations (other than utility hookups) were made.

No radioactive or hazardous materials were stored in the trailer. No other structures or facilities were affected by the fire. The trailer was a total loss.

Analysis: Due to extensive damage in the roof area of the room of origin, the exact cause of the fire could not be determined. Electricians eliminated the heaters as the

LESSONS LEARNED

cause of the fire. Both heaters were verified to be operable at the time of the fire and there was no mechanical failure of the units.

The most likely cause may have been some foreign material (such as a rodent nest) in the ductwork downstream of the heating units. The trailer was unoccupied for a long period of time before it was moved to its present position. The heaters had been operated before the fire; construction personnel had noticed a very faint odor during these brief periods of use. On the day the fire occurred, the heating units ran longer than they had previously. It is possible that the additional time allowed some foreign material in the ductwork to heat to the ignition point.

Fires in relocatable structures frequently cause more extensive damage than would be found in fixed buildings. This may be due to two factors:

1. Relocatable structures are not always required to have fire suppression systems installed in them. Fire suppression systems begin fighting the fire before emergency response personnel arrive. In structures without suppression systems, extensive damage may occur before emergency response personnel arrive. (A fire alarm system was being installed in the trailer; completion was expected in about four weeks.)
2. Relocatable structures are often built with lightweight, combustible materials. This type of construction may lead to more extensive damage and pose a greater safety hazard.

Recommended Actions:

1. HVAC systems, including heating units and downstream ductwork, should be inspected after periods of unuse to ensure all systems are functioning properly and no foreign material has accumulated in the ductwork.
2. Managers should ensure that, before they are used, all relocatable structures (including temporary trailers) meet DOE-ID Architectural Engineering Standards, Appendix K, Standard for Trailers, Modular Buildings, and Relocatable Structures, which implements DOE-STD-1088-95, Fire Protection for Relocatable Structures.
3. Personnel using relocatable structures should be fully trained in applicable safety procedures.

U1A Electric Shock - High Potential Near-Miss Incident

LESSONS LEARNED

Lessons Learned: Identification and isolation of electrical sources should be part of lockout/tagout whenever the potential for inadvertent contact exists.

Discussion: On April 8, 1997, at approximately 1630 hours, a Bechtel Nevada electrician with the Fleet and Equipment Department, was disconnecting a lead on the low side of a transformer at the Nevada Test Site U1A Complex. The electrician received a shock in his left hand, at which time he immediately pulled his hand away. He was not burned or injured and declined medical attention because the shock was in his hand only and had not gone through vital organs.

The supervisor was surprised that the electrician was shocked because the commercial power to the transformer was locked out/tagged out and both sides of the transformer were tested and no voltage was found.

Analysis: An investigation found that the electricity which shocked the electrician was fed to the transformer circuit through an intermittent fault in one of the transformer's temperature indicator sensors. This occurred as he was working on the transformer circuit. This sensor was being powered by the Uninterruptable Power Supply (UPS) on the 120-volt AC sensing circuit. Schematic drawings show that the sensing circuit is not normally able to feed the transformer circuit. An electrical safety specialist observed that one of the incident transformer's temperature sensing probes was not in its insulator tube, but was installed along side the tube where it could touch the transformer's circuit. As the probe cooled or if the surroundings were bumped, an intermittent fault could occur. In his opinion, the UPS powered sensing circuit should have been locked out because when the cover was removed from the transformer to do work on it, energized parts of the sensing circuit would have been exposed to inadvertent contact by anyone working on the transformer.

Recommended Actions: Wording concerning the identification of energized sources and planning to isolate them is being strengthened in the Bechtel Nevada Logout/Tagout Procedure. Additionally, transformers of a similar type at the Nevada Test Site will be inspected to be certain that the temperature probe is properly mounted inside the insulator.

Electrical Shock at the Transportable Vitrification Project

Lessons Learned: During the design of a system or component, identification of conditions that may threaten the safety of personnel operating, testing, maintaining, or adjusting the system or component, ensures measures are designed and implemented to protect personnel.

LESSONS LEARNED

Discussion: At approximately 1000 hours on August 5, 1997, an operator at the Transportable Vitrification System (TVS) Project received a minor electrical shock while using a ratchet to torque the binding steel bolts on the main melt chamber. There were no burns or evidence of damage to the operator's hands. Electrical power was removed from the area where the event occurred, and the work controlling procedure was redlined to require removal of electrical power any time work was going to be performed in the area. An investigation into the source of the voltage was conducted.

Electricians measured 15 volts AC on the support for the jack bolt on the south side of the trough leading to the glass drain. They measured 118 volts AC on the top panel on the trough leading to the glass drain. Zone 4 of the electrode circuits was deenergized to isolate the source of the voltage. The main melt chamber and attached components are ungrounded and insulated from each other.

Analysis: During the design and review process for the TVS melter, the potential for electrical shock to personnel performing binding steel adjustments was considered. Measures were incorporated in the design of the melter to mitigate the potential for electrical shock, however, the condition discussed in this alert was not predicted. The TVS melter is a refractory-lined melter with a submerged throat that connects the glass drain bay to the main melter. The throat is constructed of high chrome refractory, encased in a shell of water-cooled stainless steel panels. The application of cooling panels directly to the exterior face of the refractory is done to extend the life of the throat by limiting wear and erosion that occur in this high flow area.

During heat up of the melter, the cooling panel on the submerged throat between the main melt chamber and the drain bay had a voltage potential to ground of 118 volts and a current from the cooling panel to ground of 7.6 milliamps. This condition caused the operator to feel an electrical shock when making contact with the cooling panel.

During heat up, the glass in the main melt chamber and the drain bay becomes molten and conductive before the glass in the throat. By design, power can be applied to the throat area to help maintain the glass in a molten state. Electrically, this is the equivalent of placing a potential through the throat. Before the glass in the throat is molten, the path of least resistance between the main melt chamber and the drain bay is the high chrome refractory. This was the cause of the voltage potential on the throat cooling panels. Once normal operating conditions are reached, (i.e., the glass in the throat becomes molten), the glass becomes the path of least resistance, and voltage levels drop on the panel. Voltage measurements taken on the panel after the glass had become molten showed a value of 50 volts and no discernible current (i.e., no measurable milliamps). This condition is only present when Zone 4 of the six melter zones is energized. Zone 4 of the melter is energized under normal operations.

LESSONS LEARNED

The requirement for removing electrical power while adjusting jack bolts was optional per the procedure controlling this operation.

Recommended Actions:

1. Barriers (plastic panels) were installed to ensure cooling panels could not be contacted by operations personnel while adjusting jack bolts.
2. Controlling procedures were revised to require electrical power to be turned off while jack bolts are adjusted. This revision was reviewed with appropriate operations personnel.
3. Technology demonstrations involve the development of new equipment and designs. Ongoing reviews are necessary during operations to find potential problems not recognized or understood during design.

Near Miss Electrical Shock

Lessons Learned: The protection or placement of electrical outlets on workbenches can decrease the potential of electrical shock to workers.

Discussion: An employee was cutting some band-saw blades to length on a steel workbench. The band-saw material came packaged wound up in a box. In order to cut to length, the employee had to pull out the desired length of blade, cut it off, and weld the ends together. As the employee cut the blade off on one end, the other end slid off the workbench and struck the plug on a battery charger plugged into an outlet mounted on the vertical edge of the workbench. The plug was partially pulled out of the socket, but was still energized. When the steel blade struck the male part of the partially exposed plug it caused a short and tripped the breaker.

The employee was not shocked or injured, but did see sparks fly when the blade contacted the exposed plug.

Analysis: Mounting plug outlets on the sides of workbenches is a common practice. The outlet mountings in this workshop were not in the same place on all of the workbenches. Additionally, the battery charger plug was an old two prong model with no ground pole. This made it easier to work its way out.

Recommended Actions: To prevent recurrence of this incident, the employee made a cover that was mounted above the outlet. The cover protects the outlet and shields it from unintentional access to plugs that may become partially exposed. Additionally,

LESSONS LEARNED

employees performing work on workbenches in this workshop were made aware of this potential problem.

All work areas with workbenches should be evaluated to insure that the potential for partially exposed plugs is minimized or eliminated. Other preventive measures that can be taken:

- Equipment with the old two prong model plugs should be plugged in an outlet that is away from workers workbenches. If this is not feasible, replace either the equipment or the plug.
- Mount plug outlets underneath workbenches where contact with partially exposed plugs is less likely to occur.

Near Miss Incident Involving Digging

Lessons Learned: When digging without the benefit of accurate and updated drawing showing all utilities (electrical, gas, water, etc.) a tracer should be included into the procedure for proper identification and location.

Discussion: On November 14, 1997, contractors were using a hydraulic hand concrete saw to make the initial cuts through the concrete in Building 6. A hydraulic hand saw was used due to the inability of using a gas powered walk behind concrete saw due to the CO and CO₂ emissions generated inside the building. The hydraulic saw used a gasoline motor located outside the building with two water lines connected directly to the hand saw. Two sets of cuts (one for each side of the trough) were made for the entire trough. The saw used a 12-inch concrete carbide blade. The cuts were completed without incident.

The next step involved removal of the concrete with a small back hoe and hand tools. It was discovered the following week that four conduit lines were either broken or cut into by the saw. Work was temporarily suspended at this time. Three conduit lines containing 400 amps, 480 volts had been cut into. The cuts into the conduit did not extend into the electrical leads. Cuts ranged from just nipping the conduit to an inch into the conduit. One 110-volt line was torn out by the back hoe.

Analysis:

1. The B-6 building was renovated in 1988.
2. The projects *As Built Plans* for renovation were not turned over to DOE for the files.

LESSONS LEARNED

3. The conduit was laid ON TOP of the base gravel then 5.5 to 7.0 inches of concrete was poured for the floor.
4. A digging permit was issued (by SARS procedure a digging permit is not necessary for inside a building).
5. A schematic electrical floor plan drawing (E890136) is on file. The drawing was never signed off on and is incomplete.
6. The schematic shows all electrical lines going overhead with no indications of the floor routed conduits.
7. Personnel examined the drawings as per the Digging Permit Procedure.
8. NEC Code 70 300-5 does not require depth and designation of lines laid under more than 4 inches of concrete.
9. Concrete thickness varied 5.5 to 7 inches in depth.
10. The hand saw utilized water spray in the cutting process.
11. The saw cuts a 6-inch depth.
12. The individuals using the hand saw were kneeling on the ground using the saw.
13. It was stated the breaker for the 110 volt circuit did not trip when the circuit was severed when dug through.
14. Three conduits from panel B6 P2 do leave the box and enter the floor but there is no indication in which direction they travel.
15. All procedures were followed to prepare and execute the tasks.
16. Extra safety procedures were included by performing a Digging Permit.
17. Employees were trained on the equipment utilized.
18. There were no apparent NEC codes violated at this time.
19. There was no disruption in operations to the facility.
20. Two days of construction operation were disrupted due to investigation, evaluation, modifications and repairs.

The possibility of a fatality or serious injury was near missed due to the voltage and the grounding path the employees would have made by working in wet conditions.

Recommended Actions: All future diggings within building floors, where suspected electrical, gas or utility lines may be located, a tracer should be included into the procedure for proper identification and location.

Near Miss Oxygen Deficiency Incident

Lessons Learned: When using an air-purifying respirator equipped with a tight fitting face piece, the inlet opening containing the filter(s), cartridge(s), or canister(s) should never be obstructed.

LESSONS LEARNED

Discussion: Recently a welder's hood (i.e., flame-resistant and anti-contamination clothing) covered the full face negative pressure respirator's air-purifying canister resulting in a near miss oxygen deficiency incident.

The welder wore the respirator-hood combination, flame-resistant coveralls, and flame-resistant anti-contamination coveralls to work less than 15 minutes cutting several bolts with an oxyacetylene torch inside an open tank. Upon entering the tank, the welder felt dizzy, he then exited the tank and removed the hood and respirator, and notified his supervisor of the incident.

Analysis: The utilized respirator-hood combination resulted in trapping exhaled air between the welder and inner surface of the hood which resulted in restricted ambient air exchange. This resulted in the welder rebreathing his exhaled air.

According to the American National Standards Institute's (ANSI) American National Standard for Respiratory Protection, ANSI Z88.2-1992, a respirator wearer breathes in normal air at 20.9 percent oxygen, part of the oxygen is absorbed to be used by the body. On exhalation, the breath will at first consist of this same air, since there is little oxygen/carbon dioxide exchange at the top of the lung. As the respirator wearer continues to exhale, and more carbon dioxide is released, the last portion of the breath may contain 5 percent carbon dioxide and 16 percent oxygen.

Also, the hood used by the welder was specifically designed to be utilized with an air-purifying respirator utilizing belt-mounted cartridges.

LESSONS LEARNED

Recommended Actions: This near miss emphasizes the following points:

- Teams planning and working with personal protective equipment (PPE) for hazards that require respiratory protection are reminded to observe the compatibility of each part of the PPE suggested for combinations of different hazards such as flame, potential chemical agents, and radionuclides.
- Respirator wearers must receive an explanation of the operation, capabilities, and limitations of the respirator utilized for personal protection.

Carbon Monoxide Enters Confined Space

Lessons Learned: Personnel working around confined spaces must always be aware of operating equipment that emits exhaust gases containing carbon monoxide and hazardous combustion products. Failure to recognize may lead to these gases entering a confined space.

Discussion: Wednesday morning, July 30, 1997, an electrical manhole (i.e., a low risk confined space) was reviewed before entry. Standing water, which is commonly found in manholes, was present in the confined space. In order to remove the water, a pump was placed approximately 10 feet from the confined space entrance (i.e., pump exhaust toward the entrance) because of the short water hose length.

Analysis: After the water was removed, the initial confined space atmospheric check determined the carbon monoxide level was 24 parts per million (ppm). The carbon monoxide threshold limit value is 25 ppm with an action level of 12.5 ppm. Entry into the confined space was not allowed.

Recommended Actions: The confined space was ventilated for approximately 30 minutes and then a second atmospheric check did not detect any carbon monoxide or other atmospheric contaminants. Entry into the space was then allowed.

Personnel working in or around confined spaces should be aware of the following issues.

- Gas powered equipment should be positioned such that exhaust gases are not introduced into the confined space.
- Equipment should be placed at a reasonable distance downwind, and/or with the exhaust pointing away from the confined space entrance.
- As an added measure of protection, extension units may be attached to the exhaust to further increase distance from the confined space.

LESSONS LEARNED

- If results indicate elevated levels of potentially hazardous substances, the confined space should be adequately evaluated before allowing any entry.
- Finally, confined space entries must adhere to requirements as specified in SH-138PD, "Confined Space Program" or according to contract specifications.